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Theo A. F. Kuipers

**TOWARD A GEOMETRICAL THEORY OF TRUTH
APPROXIMATION
REPLY TO THOMAS MORMANN**

The contribution by Thomas Mormann also escapes the risk of the phenomenon that I indicate in my reply to Burger and Heidema, viz. losing track by confronting philosophy of science with advanced techniques in logic and mathematics. Whereas Heidema and his collaborators, in much of their previous work, and Zwart (1998/2001) have illustrated the fruitfulness of looking at truth approximation from the algebraic point of view, Mormann, following David Miller, makes an impressive plea for the geometric point of view for this purpose. Quite convincingly he argues in the last two sections that, assuming that theories fit into so-called interval structures, it is possible and hence advisable to define “objective” concepts of truthlikeness, that is concepts that naturally arise from these interval structures.

More generally, Mormann shows that *prima facie* different approaches to truthlikeness have more in common than one would expect. Whereas, for example, Zwart (1998/2001) draws a sharp distinction between what he calls “content” and “likeness” theories, such as my naïve and refined account, respectively, Mormann points out that there is much conceptual continuity between them. Note that this is in line with my claim that the naïve theory is an extreme or idealized special case of the refined approach (ICR, p. 165, see also Kuipers, forthcoming). However, in contrast to my claim (e.g. ICR, pp.258-60) that Niiniluoto’s quantitative approach and my qualitative one are worlds apart, Mormann also argues that the quantitative approach can be reconstrued in a qualitative way.

Below I would like to come back to our dispute about the quantitative approach and further discuss the possibility of including theoretical terms and their reference in Mormann’s geometrical approach.

In: R. Festa, A. Aliseda and J. Peijnenburg (eds.), *Confirmation, Empirical Progress, and Truth Approximation (Poznań Studies in the Philosophy of the Sciences and the Humanities, vol. 83)*, pp. 455-457. Amsterdam/New York, NY: Rodopi, 2005.

The Reach of the Qualitative and the Quantitative Approach

As stated, and assuming that I understand Mormann correctly, his basic claim with respect to the quantitative versus qualitative approach to truthlikeness is that the former can be reconstrued in a qualitative way. Without entering into his geometric argument (culminating in Theorem 3.6) I would like to endorse Mormann's general claim "that there is no principled difference between the two realms" (p. 440). At issue is the meaningfulness of "going quantitative" in specific cases. Let me quote the most relevant passage of ICR (p. 258) in this respect:

Let us therefore turn to the fundamental problem of a quantitative approach, the use of a distance function between structures. Although Niiniluoto's proposals for definitions of quantitative truthlikeness based on distances between structures [presented in Ch. 12 of ICR] are impressive, the problem is that apart from some exceptional cases, see below, there usually is nothing like a natural real-valued distance function between the structures of scientific theories, let alone something like a quantitative comparison of theories based on such a distance-function. And even in cases where it is technically easy to define a distance function, as in some paradigm examples of the structuralist approach, e.g., between the potential models of classical particle mechanics (CPM), as far as they share the same domain and time interval, such a distance function seems never to be used by scientists. The main reason obviously is that as soon as there are two or more real-valued functions involved indicating quite different quantities, and hence expressed in quite different units of measurement, any 'overall' distance function has equally many fundamentally arbitrary aspects. For we have to add in one way or another functions with values in meters (*m*) for position, kilograms (*kg*) for mass and newtons (*kg·m/sec²*) for force. One should not be misled by the fact that scientists frequently compare models quantitatively, even in terms of distances. However, what they do in such cases is quantitatively comparing one (type of) function, hence one aspect of such models, but that is not at stake. If we want to compare e.g., classical particle mechanics with special or general relativity theory we have to take full potential models into account.

Hence, I would agree with Mormann when he writes in closing Section 3:

Summarizing, we may say that the theory of truth approximation is well advised to subscribe to a moderate pluralism: for some areas, metric methods of truth approximation may be available, for others only weak 'qualitative' methods may be appropriate, for still others interval structures of an intermediate kind may turn out to work best. (p. 444)

However, despite Mormann's formally correct point, and despite his plausible plea for a moderate pluralism in these matters, I would like to stick to the above arguments for reservations with respect to the quantitative approach as an approach to be generally advised, for those arguments are not really touched by the formal point. That is, in line with Mormann's suggestion, we should go as far as is appropriate.

However, there may be one way to question my attitude. Recall that I started this reply by agreeing with Mormann's final plea for specific concepts of truthlikeness that naturally arise from the relevant interval structures. If

Niiniluoto, or somebody else, wants to plea for the quantitative approach as an approach to be generally advised and were to advance convincing arguments for claiming, for example, that physicists would profit from designing interval structures that are specific enough to define real-valued distances between models of particle mechanics, then I would be convinced. As long as this is not the case, I would suggest we try to be no more specific than appropriate in specific cases and try to make general statements about truthlikeness and truth approximation on the basis of assumptions that are as weak as possible.

Theoretical Terms and Their Reference in Mathematical Perspective

Mormann's account is on the one hand very attractive: it streamlines various *prima facie* totally different approaches and opens new ways (see Section 5) for dealing with standing problems such as how to allow false theories that "outdistance" true ones (TR4) and how to minimize language dependence as much as possible. In this respect, Mormann's geometric approach and the algebraic approaches of Burger and Heidema (this volume) and of Zwart (1998/2001) are very promising. However, as far as I know, neither type of approach yet touches the problem of reference of theoretical terms. From the philosophy of science point of view this is a very important point, e.g. see Ruttkamp's contribution to the companion volume in which she favors a basically epistemological approach to reference, rather than a semantic-cum-metaphysical one. To be sure, from my reply to her, it is not only clear that I think that my formal, but semantic-metaphysically oriented treatment of this problem in Ch. 9 of ICR is formally a step ahead, but also that it still leaves much to be desired, semantically as well as metaphysically. I consider it as a challenge to both types of mathematical approach to try to deal with this problem in a way that is formally as well as philosophically adequate.

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